5-2010

Long-Run Wage and Earnings Losses of Displaced Workers

Roger White
Franklin & Marshall College, rwhite1@whittier.edu

Applied Economics, 2008, 1–12, iFirst

Routledge
Taylor & Francis Group

Long-run wage and earnings losses of displaced workers

Roger White

Department of Economics, Franklin and Marshall College, Lancaster, PA 17603, USA
E-mail: roger.white@fandm.edu

Displacement-related losses are estimated using National Longitudinal Survey of Youth data that span the years 1979–2000. The typical displaced worker faces losses of $34 065 during the period 4 years prior through 5 years following displacement. Proportionally, this represents a 10.8% loss compared to earnings of similar nondisplaced workers over the period. Considerable variation in losses is reported across worker types. Union, male and more mature workers suffer greater losses, respectively, than do their nonunion, female and younger counterparts. College graduates and high school dropouts are found to suffer lower losses compared to high school diploma holders and those who completed some college.

I. Introduction

More than four decades have passed since the Trade Expansion Act of 1962 established the Trade Adjustment Assistance (TAA) programme. The TAA Reform Act of 2002 extended traditional TAA, consolidated the North American Free Trade Agreement–TTA (NAFTA-TTA) programme into the TAA programme and established a wage insurance programme dubbed alternative TAA. These programmes are designed to aid displaced workers and, while studies of long-run displacement-related wage and earnings losses have identified significant losses, potential heterogeneity in losses across worker types has received scant attention. This research fills the associated void within the literature. Using National Longitudinal Survey of Youth (NLSY79) data, we quantify displacement-related losses and investigate the time paths of losses for the full sample of workers and for several worker types. A finding of heterogeneity in the timing, duration and magnitude of losses across worker types would provide valuable information that may aid future policy formulation.

Prior research, employing various data sources, identifies the loss of firm- or industry-specific human capital and characteristics such as age, gender, pre-displacement tenure/experience and educational attainment as influencing losses. Using Displaced Worker Survey (DWS) data, Neal (1995) and Addison and Portugal (1989) documented wage losses associated with industry and/or occupation switching. Farber (2005) found earnings losses following displacement regardless of education level with more-tenured workers suffering greater losses than comparable less-tenured workers. Podgursky and Swaim (1987) reported greater median earnings losses for blue-collar and, as opposed to, white-collar workers. Kletzer and Fairlie (2003), employing NLSY79 (United States Bureau of Labour Statistics (BLS), 2002) data, reported younger displaced workers face earnings losses, which when coupled with the earnings growth witnessed by their nondisplaced peers, increase earnings gaps.

Regarding the timing of losses, prior to displacement a divergence is seen between the real wages of workers that are subsequently displaced and wages of other workers (Blanchflower, 1991 (Great Britain data); Ruhm, 1991 (Panel Study of Income Dynamics (PSID) data); Jacobson *et al*., 1993 (State of Pennsylvania data); de La Rica, 1995 (DWS data);

Applied Economics ISSN 0003–6846 print/ISSN 1466–4283 online
http://www.informaworld.com
DOI: 10.1080/00036840701736206

Kletzer and Fairlie, 2003 (NLSY79 data)). Immediately following displacement, workers face substantial losses. Examining DWS data, Carrington and Azad (1994) and Kletzer (2001) reported weekly earnings losses, once re-employed, of 13%. Farber (1993) reported losses of 9%. As only about one-half of displaced workers are re-employed by the DWS survey date, losses may be understated (Hall and Pencaval, 1993). Earnings are found to remain below expected levels for many years. Examining PSID data, Ruhm (1987) and Stevens (1997) reported losses 4 or more years after displacement. Similarly, Jacobson *et al.* (1993) reported earnings 25% below expected levels 5 years after displacement, and estimate long-run earnings losses to be approximately $50 000.

The longitudinal nature of the NLSY79 permits estimation of aggregate monetary losses and examination of the associated time paths of such losses. The data employed here include workers 18–44 years of age, thus encompassing a large portion of the workers' prime earning years. Kletzer and Fairlie (2003), the only prior work to examine heterogeneity in long-run losses, used NLSY79 data to examine losses of young male and female workers during the 1983–94 period. Using a lengthier time frame (1979–2000), we employ NLSY79 data to estimate comprehensive displacement-related losses for all workers and for a wider variety of worker types defined by union affiliation, age, gender and level of educational attainment.

II. Empirical Specification

To quantify the wage losses of displaced workers, we follow Jacobson *et al.* (1993) by modelling losses as the difference between observed wages given that worker i will/has experience/experienced a displacement and the expected wages of a comparable nondisplaced worker. Equation 1 illustrates the estimated loss for displaced worker i at time t.

$$E(w_{it}|D_{is}=1, I_{is-p}) - E(w_{it}|D_{iv}=0 \ \forall v, I_{is-p}) \quad (1)$$

Here I_{is-p} is an information set containing worker-specific earnings determinants regardless of whether worker i was displaced. The variable p is assumed to be a sufficiently lengthy period of time such that the events leading to displacement have yet to begin. Within the information set are observable determinants of the wage rate such as age, gender, race, ethnicity, job tenure, education, union affiliation as well as nonobservable characteristics. The time-invariant and time-varying characteristics of the worker along with exogenous factors permit the wage components of Equation 1 to be rewritten more formally.

$$w_{it} = \alpha_i + \beta_\gamma \gamma_t + \beta_\chi \chi_{it} + \sum \delta_k D_{it}^k + \varepsilon_{it} \quad (2)$$

The hourly wage rate is given as w_{it}. A vector of individual-specific fixed effects coefficients, α_i, captures time-invariant differences across workers. Allowing for variation in losses over time, a set of year dummy variables, γ_t, is included. Time-varying worker-specific attributes are included in the vector χ_{it}. The set of dummy variables, D_{it}^k, represents the event of displacement and δ_k measures the effect of displacement in the years prior to or following displacement. Specifically, $D_{it}^k = 1$ if worker i was displaced k years prior to or since year t and $D_{it}^k = 0$ if worker i was not displaced during the period. The error term is assumed to be mean 0, of constant variance, and uncorrelated across individuals and time. Substituting Equation 2 into Equation 1 yields:

$$E\left(\alpha_i + \beta_\gamma \gamma_t + \beta_\chi \chi_{it} + \sum \delta_k D_{it}^k + \varepsilon_{it} | D_{it}=1 \ \forall v, I_{is-p}\right) - E\left(\alpha_i + \beta_\gamma \gamma_t + \beta_\chi \chi_{it} + \sum \delta_k D_{it}^k + \varepsilon_{it} \big| D_{iv}=0, I_{is-p}\right) \quad (3)$$

As $D_{iv}=0$, Equation 3 reduces to $\sum \delta_k D_{it}^k$. Decomposition of this summation yields a measure of the wage loss during each k year prior to or since displacement.

Analysed time-varying characteristics include age (in years), tenure (in weeks), and union affiliation (equal to 1 if the worker's wages are set by collective bargaining; 0 otherwise). Squared values of age and tenure capture potential nonlinearity. Thus, Equation 2 can be rewritten as follows:

$$\begin{aligned} \ln \text{REAL WAGE}_{it} &= \alpha_i + \beta_\gamma \gamma_t + \beta_1 \text{AGE}_{it} + \beta_2 \text{AGE}_{it}^2 \\ &+ \beta_3 \text{TENURE}_{it} + \beta_4 \text{TENURE}_{it}^2 \\ &+ \beta_5 \text{UNION}_{it} + \beta_\gamma \gamma_t + \delta_1 D_{it}^{-5} + \delta_2 D_{it}^{-4} \\ &+ \delta_3 D_{it}^{-3} + \delta_4 D_{it}^{-2} + \delta_5 D_{it}^{-1} + \delta_6 D_{it}^{0} + \delta_7 D_{it}^{1} \\ &+ \delta_8 D_{it}^{2} + \delta_9 D_{it}^{3} + \delta_{10} D_{it}^{4} + \delta_{11} D_{it}^{5} + \delta_{12} D_{it}^{6} \\ &+ \delta_{13} D_{it}^{7} + \delta_{14} D_{it}^{8} + \delta_{15} D_{it}^{9} + \delta_{16} D_{it}^{10} + \varepsilon_{it} \end{aligned} \quad (4)$$

In the analysis to follow, to consider the existence of and examine the magnitude and timing of potential displacement-related wage losses, we estimate Equation 4 for the full sample of worker observations and for each worker type. The coefficients on the D_{it}^k

variables measure the percentage difference between wages of displaced workers and wages of workers who are not displaced, all else equal. We employ a 16-year window (5 years prior to displacement through 10 years following displacement) to measure losses. The individual fixed effect coefficient, α_i, represents time-invariant characteristics of worker *i*. The functional form of Equation 4 is semi-logarithmic. Each coefficient represents the percentage change in the real wage rate given a one-unit change in the corresponding independent variable, all else constant. To examine the impact of displacement on earnings, an alternative version of Equation 4 is estimated where real annual earnings serves as the dependent variable.

III. Data

The longitudinal design of the NLSY79 makes it particularly well suited for measuring wage and earnings losses. NLSY79 respondents recall their labour market experiences since the last survey in which they participated – usually a 1- or 2-year period. If a worker is separated from a job due to either a 'layoff' or 'plant closing', the worker is classified as displaced.[1] Workers who did not change jobs or who left a job voluntarily or for any other involuntary reason are classified as nondisplaced. Similarly, workers who returned to the job from which they were separated are classified as nondisplaced. This permits construction of a nondisplaced control group to which displaced workers can be compared to quantify displacement-related wage and earnings losses.

To ameliorate the influence of outlying or misreported values, we remove observations reporting real hourly wages below \$3 or above \$500 and observations reporting real annual earnings below \$3900 or nominal annual earnings above \$95 000.[2] For this same reason, we remove observations listing <1 year of education. To exclude workers without strong labour force attachments, observations indicating school enrolment or military enlistment or that report 25 or fewer hours worked in a typical week were excluded. To avoid inclusion of seasonal displacements, we remove observations reporting employment in or displacement from the construction or agricultural industries.

Although the NLSY79 has been conducted biennially since 1994, observations for 1995, 1997 and 1999 have been constructed based on responses to the 1994, 1996, 1998 and 2000 surveys. Each survey lists responses for up to five jobs and, based on reported values for job tenure and weeks of unemployment, we have identified if the worker was employed and, if so, the job held during the survey week for the year during which no survey was conducted. Once this job was determined, each observation was classified as having been displaced or not and values for real hourly wage rates and real annual earnings were constructed. The result is a final dataset consisting of 33 606 worker year observations spanning the period from 1979–2000.

Table 1 reports descriptive statistics. As displacement incidence, wages and earnings vary across worker types, displacement-related monetary losses may also vary. We see the displacement rate for male workers, 6.4%, is higher than that of female workers, 5%. The rate for the youngest worker group is 10.4%. This value falls to 6.7% and 3.4% for the middle and eldest worker groups, respectively. Workers with less than a high school diploma have a displacement rate of 9.1%, while workers with at least a 4-year college degree have a rate of 2.3%.

Male workers have higher average real hourly wages, \$13.72, than their female counterparts, \$11.47. The average wage for workers with less than a high school diploma is \$8.59 while the typical college-educated worker receives \$19.87. The mean wage rate for the youngest group is \$8.71 while the middle and eldest groups have values of \$11.47 and \$13.72, respectively. For the most educated portion of the sample, the mean value for real annual earnings is \$37 996, while workers who failed to complete high school report average earnings of \$28 518. The eldest group has annual earnings of \$37 011 while the middle and youngest groups report values of \$29 339 and \$21 228, respectively.

IV. Estimated Displacement-related Wage and Earnings Losses

Estimation results, for the full sample and the various worker types, are presented in Tables 2–6. Time paths of estimated losses are illustrated in Figs 1–10.

[1] During the 1979–83 survey years, no distinction was made for job loss due to plant closure. For these years, we define a worker as having been displaced if the reason cited for leaving the job as 'layoff'.

[2] The upper bound is due to top-coding in the NLSY79 data. The lower bound is based on annual earnings if an individual was employed, on average, 25 h per week for 50 weeks each year at a real wage of \$3. The US Consumer Price Index was employed, with 1995 set as the base year, to deflate nominal values.

Table 1. Descriptive statistics, all workers and by sample sub-classifications

	Observations											
	All workers		Union workers		Nonunion workers		Workers 18–24 years of age		Workers 25–34 years of age		Workers 35–44 years of age	
Variables/samples	33 606		2558		31 048		6765		9849		16 992	
Displacement rate	0.057	(0.335)	0.0637	(0.356)	0.0572	(0.333)	0.1035	(0.414)	0.0668	(0.357)	0.0341	(0.240)
Real hourly wage rate	12.052	(9.930)	12.766	(9.938)	11.993	(10.953)	8.712	(12.565)	11.465	(9.942)	13.719	(10.631)
Real annual earnings	31 598.52	(21 638.139)	35 898.42	(16 956.44)	31 236.31	(21 638.67)	21 227.64	(21 018.42)	29 339.06	(22 961.41)	37 010.74	(19 635.32)
Annual hours worked	1 973.84	(2 955.22)	1 869.42	(519.76)	1 982.43	(2 961.86)	1 661.45	(3 972.65)	1 985.97	(1 911.09)	2 090.99	(1 217.39)
Age	31.469	(6.668)	31.036	(6.882)	31.505	(6.649)	21.08	(2.701)	29.08	(2.938)	36.99	(2.122)
Education (years completed)	12.699	(2.317)	12.336	(2.273)	12.729	(2.318)	11.559	(1.821)	12.767	(2.318)	13.113	(2.410)
Female	0.447	(0.496)	0.441	(0.495)	0.448	(0.497)	0.447	(0.497)	0.419	(0.493)	0.463	(0.495)
Male	0.553	(0.496)	0.559	(0.495)	0.552	(0.497)	0.553	(0.497)	0.581	(0.493)	0.537	(0.495)
Tenure (weeks)	212.67	(250.572)	193.739	(254.302)	214.23	(245.682)	65.005	(60.423)	183.111	(204.911)	288.584	(286.875)
Union membership/coverage	0.076	(0.264)	1.000	(0.000)	0.000	(0.000)	0.086	(0.279)	0.076	(0.264)	0.072	(0.257)
	Male workers		Female workers		Workers with less than a high school diploma		Workers with a high school diploma		Workers with some college education		Workers with at least a BA/BS degree	
Variables/samples	18 593		15 013		4930		16 481		6995		5200	
Displacement rate	0.0636	(0.354)	0.0502	(0.307)	0.0913	(0.396)	0.064	(0.344)	0.0446	(0.311)	0.0231	(0.242)
Real hourly wage rate	13.226	(10.579)	10.599	(8.848)	8.592	(9.188)	10.303	(6.943)	12.589	(8.269)	19.872	(15.006)
Real annual earnings	32 048.23	(21 972.59)	31 023.13	(21 222.56)	28 517.64	(20 711.47)	29 968.21	(21 611.01)	32 642.36	(20 479.65)	37 996.12	(22 189.04)
Annual hours worked	2056.88	(3047.33)	1870.93	(2833.79)	1693.11	(4503.40)	1931.63	(3142.72)	2085.82	(1943.85)	2210.37	(1301.87)
Age	31.299	(6.638)	31.680	(6.699)	28.746	(7.303)	30.894	(6.807)	32.769	(5.998)	34.127	(4.938)
Education (years completed)	12.511	(2.371)	12.931	(2.225)	9.373	(1.581)	12.000	(0.000)	13.716	(0.716)	16.702	(1.200)
Female	0.000	(0.000)	1.000	(0.000)	0.333	(0.468)	0.434	(0.495)	0.537	(0.499)	0.475	(0.499)
Male	1.000	(0.000)	0.000	(0.000)	0.667	(0.468)	0.566	(0.495)	0.463	(0.499)	0.525	(0.499)
Tenure (weeks)	216.741	(254.595)	207.631	(245.419)	138.167	(198.717)	206.355	(254.081)	233.471	(256.171)	270.472	(255.464)
Union membership/coverage	0.078	(0.267)	0.074	(0.261)	0.099	(0.298)	0.079	(0.267)	0.0719	(0.258)	0.053	(0.223)

Note: SDs are included in parentheses. Real hourly wage rates and real annual earnings are in 1995 dollars.

Table 2. Long-run wage and earnings effects of job displacement, all workers and by union affiliation

	Dependent variables											
	All workers				Union Workers				Nonunion workers			
Variables	ln real hourly wage (a)		ln real annual earnings (b)		ln real hourly wage (c)		ln real annual earnings (d)		ln real hourly wage (e)		ln real annual earnings (f)	
Age of worker	0.0531***	(0.0024)	0.4596***	(0.0087)	0.0515***	(0.0066)	0.4273***	(0.0397)	0.0536***	(0.0025)	0.04626***	(0.0087)
Age of worker squared	−0.0005***	(0.00005)	−0.0060***	(0.0001)	−0.0003***	(0.0001)	−0.0051***	(0.0008)	−0.0005***	(0.00005)	−0.0060***	(0.0001)
Union affiliation	0.0107	(0.0090)	0.0360**	(0.0150)								
Tenure (in weeks)	0.0001***	(0.000009)	0.0002***	(0.00001)	0.0002***	(0.00003)	0.0002***	(0.00004)	0.0001***	(0.000009)	0.0002***	(0.00001)
Tenure squared	−0.00007***	(0.00001)	−0.00006**	(0.00004)	−0.0001***	(0.00002)	−0.00007**	(0.00005)	−0.00003**	(0.00001)	−0.00008***	(0.00002)
5 years before displacement	−0.0235	(0.0172)	−0.0415	(0.0290)	−0.0390	(0.0510)	−0.1005	(0.1089)	−0.0217	(0.0183)	−0.0375	(0.0304)
4 years before displacement	−0.0246	(0.0155)	−0.0389*	(0.0222)	0.0687	(0.0587)	0.0285	(0.0846)	−0.0312*	(0.0161)	−0.0425*	(0.0230)
3 years before displacement	−0.1457***	(0.0202)	−0.1331***	(0.0329)	−0.1619***	(0.0623)	−0.2655**	(0.1059)	−0.1437***	(0.0213)	−0.1250***	(0.0346)
2 years before displacement	−0.0381***	(0.0129)	−0.0567***	(0.0214)	−0.0822*	(0.0460)	−0.2308***	(0.0688)	−0.0343**	(0.0134)	−0.0447**	(0.0225)
1 year before displacement	−0.1227***	(0.0152)	−0.0786***	(0.0254)	−0.1784***	(0.0538)	−0.2178**	(0.0904)	−0.1183***	(0.0158)	−0.0684***	(0.0264)
Year of displacement	−0.0981***	(0.0072)	−0.0693***	(0.0142)	−0.1074***	(0.0243)	−0.0886*	(0.0504)	−0.0966**	(0.0075)	−0.0659***	(0.0147)
1 year after displacement	−0.1114***	(0.0148)	−0.1433***	(0.0230)	−0.1258**	(0.0504)	−0.0823	(0.0889)	−0.1107***	(0.0155)	−0.1467***	(0.0238)
2 years after displacement	−0.1415***	(0.0125)	−0.1573***	(0.0173)	−0.1262***	(0.0432)	−0.1374**	(0.0699)	−0.1424*	(0.0131)	−0.1584***	(0.0178)
3 years after displacement	−0.1686***	(0.0165)	−0.2268***	(0.0250)	−0.3937***	(0.0558)	−0.0906***	(0.0906)	−0.1518***	(0.0172)	−0.2124***	(0.0260)
4 years after displacement	−0.0734***	(0.0146)	−0.0655***	(0.0210)	−0.1191***	(0.0446)	−0.0722	(0.0734)	−0.0685***	(0.0154)	−0.0645***	(0.0219)
5 years after displacement	−0.0761***	(0.0165)	−0.0866***	(0.0252)	−0.0729	(0.0492)	−0.0859	(0.0808)	−0.0751***	(0.0175)	−0.0833***	(0.0266)
6 years after displacement	−0.0314*	(0.0165)	−0.0232	(0.0245)	−0.0304	(0.0245)	−0.0439	(0.0938)	−0.0304*	(0.0169)	−0.0215	(0.0251)
7 years after displacement	−0.0173	(0.0175)	−0.0055	(0.0249)	−0.0192	(0.0769)	0.0275	(0.1044)	−0.0156	(0.0178)	−0.0097	(0.0254)
8 years after displacement	−0.0143	(0.0198)	−0.0272	(0.0287)	−0.0187	(0.0640)	0.0805	(0.0924)	−0.0122	(0.0207)	−0.0349	(0.0300)
9 years after displacement	0.0236	(0.0196)	0.0257	(0.0261)	0.0564	(0.0846)	−0.1490	(0.1035)	0.0206	(0.0198)	0.0373	(0.0269)
10 years after displacement	−0.0294*	(0.0176)	−0.0204	(0.0224)	0.0039	(0.0775)	0.0343	(0.0993)	−0.0317*	(0.0180)	−0.0245	(0.0228)
Adjusted R^2	0.2412		0.0635		0.2214		0.1492		0.2431		0.0835	
N	33 606		27 934		2 558		2069		31 048		25 865	

Notes: Heteroskedasticity-consistent robust SEs are in parentheses. In addition to the listed independent variables, each equation includes a vector of year dummy variables and allows for individual fixed effects. Hourly wage rates and annual earnings are measured in 1995 dollars.
***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.

Table 3. Long-run wage and earning effects of job displacement, by gender

	Dependent variables			
	Male workers		Female workers	
Variables	ln real hourly wage (a)	ln real annual earnings (b)	ln real hourly wage (c)	ln real annual earnings (d)
Age of worker	0.0491*** (0.0033)	0.4566*** (0.0125)	0.0493*** (0.0030)	0.4494*** (0.0115)
Age of worker squared	−0.0003*** (0.00007)	−0.0058*** (0.0002)	−0.0005*** (0.00006)	−0.0059*** (0.0002)
Union affiliation	0.0109 (0.0119)	0.0336 (0.0214)	0.0036 (0.0126)	0.0294* (0.0177)
Tenure (in weeks)	0.0001*** (0.00001)	0.0001*** (0.00001)	0.0001*** (0.00001)	0.0001*** (0.00001)
Tenure squared	0.00007** (0.00004)	−0.00007*** (0.00001)	−0.00008*** (0.00002)	−0.000009** (0.000006)
5 years before displacement	−0.0641*** (0.0216)	−0.0884** (0.0380)	−0.0121 (0.0267)	−0.0405 (0.0393)
4 years before displacement	−0.0577*** (0.0196)	−0.0796*** (0.0287)	−0.0168 (0.0239)	−0.0397 (0.0314)
3 years before displacement	−0.1425*** (0.0273)	−0.1189** (0.0470)	−0.1762*** (0.0254)	−0.1576*** (0.0372)
2 years before displacement	−0.0606*** (0.0167)	−0.1074*** (0.0243)	−0.0417** (0.0185)	−0.0302 (0.0360)
1 year before displacement	−0.1309*** (0.0195)	−0.0686** (0.0317)	−0.1167*** (0.0227)	−0.0840** (0.0383)
Year of displacement	−0.1370*** (0.0092)	−0.1349*** (0.0189)	−0.0840*** (0.0108)	−0.0598*** (0.0200)
1 year after displacement	−0.1314*** (0.0204)	−0.2076*** (0.0304)	−0.0911*** (0.0203)	−0.1095*** (0.0332)
2 years after displacement	−0.1705*** (0.0171)	−0.2011*** (0.0228)	−0.1134*** (0.0173)	−0.1304*** (0.0238)
3 years after displacement	−0.2122*** (0.0233)	−0.2981*** (0.0336)	−0.1129*** (0.0217)	−0.1620*** (0.0338)
4 years after displacement	−0.1026*** (0.0205)	−0.1295*** (0.0280)	−0.0486** (0.0189)	−0.0296 (0.0289)
5 years after displacement	−0.0951*** (0.0226)	−0.1278*** (0.0337)	−0.0487** (0.0228)	−0.0718** (0.0338)
6 years after displacement	−0.0280 (0.0224)	−0.0296 (0.0319)	−0.0463** (0.0224)	−0.0691** (0.0331)
7 years after displacement	−0.0385* (0.0229)	−0.0562* (0.0316)	−0.0213 (0.0253)	−0.0109 (0.0368)
8 years after displacement	−0.0444* (0.0236)	−0.0690** (0.0325)	−0.0145 (0.0328)	−0.0796 (0.0496)
9 years after displacement	−0.0215 (0.0256)	−0.0348 (0.0322)	0.0422 (0.0289)	0.0166 (0.0403)
10 years after displacement	−0.0469** (0.0234)	−0.0538* (0.0294)	−0.0401 (0.0245)	−0.0479 (0.0297)
Adjusted R^2	0.2573	0.0795	0.2850	0.1120
N	18 593	15 363	15 013	12 571

Notes: Heteroskedasticity-consistent robust SEs are in parentheses. In addition to the listed independent variables, each equation includes a vector of year dummy variables and allows for individual fixed effects. Hourly wage rates and annual earnings are measured in 1995 dollars.
***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.

Table 4. Long-run wage and earnings effects of job displacement, by age classification

	Dependent variables											
	18–24 years of age				25–34 years of age				35–44 years of age			
Variables	ln real hourly wage (a)		ln real annual earnings (b)		ln real hourly wage (c)		ln real annual earnings (d)		ln real hourly wage (e)		ln real annual earnings (f)	
Age of worker	−0.0349***	(0.0035)	−0.0441***	(0.0087)	0.0540	(0.0372)	0.0801	(0.0704)	0.0554***	(0.0026)	0.4540***	(0.0029)
Age of worker squared	0.0019***	(0.0001)	0.0023***	(0.0002)	−0.0006	(0.0006)	−0.0010	(0.0011)	−0.0006***	(0.00006)	−0.0058***	(0.00006)
Union affiliation	−0.0128	(0.0135)	0.0255	(0.0211)	0.0142	(0.0153)	−0.0011	(0.0221)	0.0076	(0.0151)	0.0182	(0.0176)
Tenure (in weeks)	0.0001***	(0.00002)	0.0001***	(0.00003)	0.0001***	(0.00001)	0.0001***	(0.00002)	0.0002***	(0.00001)	0.0002***	(0.00001)
Tenure squared	−0.00006*	(0.00005)	−0.00001*	(0.00008)	−0.00008***	(0.00002)	−0.00006***	(0.00002)	−0.00009***	(0.00002)	−0.00005	(0.00004)
5 years before displacement	0.0192	(0.0218)	0.0337	(0.0362)	−0.0325	(0.0265)	−0.0498	(0.0407)	−0.1148**	(0.0525)	−0.1470**	(0.0265)
4 years before displacement	0.0414**	(0.0200)	0.0465	(0.0292)	−0.0228	(0.0257)	−0.0306	(0.0354)	−0.1016***	(0.0355)	−0.1115***	(0.0397)
3 years before displacement	−0.0385	(0.0319)	−0.0223	(0.0517)	−0.2177***	(0.0301)	−0.1561***	(0.0475)	−0.1893***	(0.0502)	−0.2254***	(0.0598)
2 years before displacement	0.0241	(0.0178)	0.0154	(0.0302)	−0.0426*	(0.0224)	−0.0494*	(0.0289)	−0.0896***	(0.0233)	−0.1135***	(0.0265)
1 year before displacement	−0.0418**	(0.0183)	−0.0246	(0.0303)	−0.1761***	(0.0293)	−0.0890**	(0.0453)	−0.1482***	(0.0434)	−0.1532***	(0.0522)
Year of displacement	−0.0686***	(0.0097)	−0.0178	(0.0196)	−0.1192***	(0.0114)	−0.1057***	(0.0254)	−0.1096***	(0.0165)	−0.0991***	(0.0114)
1 year after displacement	−0.0180	(0.0208)	−0.0233	(0.0359)	−0.1191***	(0.0237)	−0.1445***	(0.0352)	−0.1579***	(0.0339)	−0.1850***	(0.0366)
2 years after displacement	−0.0269	(0.0217)	−0.0046	(0.0346)	−0.1490***	(0.0216)	−0.2001***	(0.0301)	−0.1806***	(0.0201)	−0.1764***	(0.0224)
3 years after displacement	−0.0460	(0.0285)	−0.0166	(0.0472)	−0.1633***	(0.0250)	−0.2361***	(0.0436)	−0.2294***	(0.0310)	−0.2406***	(0.0349)
4 years after displacement	−0.0196	(0.0380)	−0.1815	(0.5219)	−0.0768***	(0.0245)	−0.1215***	(0.0426)	−0.0920***	(0.0199)	−0.0789***	(0.0223)
5 years after displacement	0.0136	(0.0402)	0.0133	(0.0393)	−0.0929***	(0.0239)	−0.1112***	(0.0428)	−0.0845***	(0.0268)	−0.0983***	(0.0301)
6 years after displacement	0.0043	(0.0614)	0.0036	(0.0514)	−0.0138	(0.0267)	−0.0204	(0.0519)	−0.0616***	(0.0223)	−0.0629**	(0.0249)
7 years after displacement	0.0642	(0.0794)	0.0803	(0.0993)	−0.0080	(0.0233)	−0.0269	(0.0370)	−0.0512*	(0.0272)	−0.0517*	(0.0301)
8 years after displacement	0.0370	(0.1133)	0.1684	(0.0516)	−0.0124	(0.0237)	−0.0398	(0.0379)	−0.0378	(0.0367)	−0.0403	(0.0422)
9 years after displacement	0.4640***	(0.1622)	0.1567	(0.1351)	0.0356	(0.0242)	0.0287	(0.0354)	−0.0318	(0.0330)	−0.0272	(0.0359)
10 years after displacement	0.2987	(0.1880)	1.1948	(0.7520)	−0.0277	(0.0245)	−0.0323	(0.0343)	−0.0542**	(0.0251)	−0.0491*	(0.0277)
Adjusted R^2	0.1131		0.1061		0.1868		0.1959		0.2456		0.2140	
N	6765		4593		9849		8660		16992		14 681	

Notes: Heteroskedasticity-consistent robust SEs are in parentheses. In addition to the listed independent variables, each equation includes a vector of year dummy variables and allows for individual fixed effects. Hourly wage rates and annual earnings are measured in 1995 dollars.
***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.

Table 5. Long-run wage effects of job displacement, by level of educational attainment

	Dependent variables: ln real hourly wage rate			
Variables	Less than a high school diploma (a)	High school diploma or equivalent (b)	Some college (c)	At least a 4-year college degree (d)
Age of worker	0.0775*** (0.0096)	0.0137*** (0.0051)	0.0543*** (0.0084)	0.0703*** (0.0101)
Age of worker squared	−0.0008*** (0.0002)	−0.00002 (0.00008)	−0.0005*** (0.0001)	−0.0007*** (0.0001)
Union affiliation	0.0226 (0.0174)	0.0054 (0.0121)	0.0344 (0.0213)	−0.0244 (0.0322)
Tenure (in weeks)	0.0002*** (0.00002)	0.0002*** (0.00001)	0.0001*** (0.00002)	0.0001*** (0.00001)
Tenure squared	−0.00006*** (0.00002)	−0.00005** (0.00003)	−0.00008*** (0.00005)	−0.00009*** (0.00001)
5 years before displacement	0.0053 (0.0367)	−0.0352 (0.0224)	−0.0577 (0.0414)	−0.0215 (0.0685)
4 years before displacement	−0.0176 (0.0288)	−0.0248 (0.0212)	0.0414 (0.0381)	0.0544 (0.0680)
3 years before displacement	−0.0708 (0.0478)	−0.1558*** (0.0244)	−0.2512*** (0.0495)	−0.2055*** (0.0706)
2 years before displacement	−0.0009 (0.0257)	−0.0340* (0.0174)	−0.0419 (0.0312)	−0.0677 (0.0487)
1 year before displacement	−0.0993*** (0.0246)	−0.1232*** (0.0206)	−0.1981*** (0.0401)	−0.0916 (0.0631)
Year of displacement	−0.0546*** (0.0139)	−0.1091*** (0.0093)	−0.0978*** (0.0177)	−0.1505*** (0.0294)
1 year after displacement	−0.0620* (0.0338)	−0.1074*** (0.0196)	−0.1402*** (0.0339)	−0.0560 (0.0474)
2 years after displacement	−0.1198*** (0.0246)	−0.1407*** (0.0172)	−0.1148*** (0.0296)	−0.1324*** (0.0411)
3 years after displacement	−0.1017*** (0.0336)	−0.2132*** (0.0242)	−0.1572*** (0.0383)	−0.0697 (0.0437)
4 years after displacement	0.0038 (0.0377)	−0.0853*** (0.0194)	−0.0605* (0.0310)	−0.0858* (0.0445)
5 years after displacement	−0.0083 (0.0383)	−0.0561** (0.0218)	−0.1149*** (0.0361)	−0.0998* (0.0551)
6 years after displacement	0.1030*** (0.0325)	−0.0300 (0.0225)	−0.1237*** (0.0346)	−0.0170*** (0.0586)
7 years after displacement	0.0333 (0.0351)	−0.0163 (0.0239)	−0.0509 (0.0437)	−0.0171 (0.0507)
8 years after displacement	0.0503 (0.0442)	−0.0159 (0.0269)	−0.0057 (0.0466)	−0.0311 (0.0607)
9 years after displacement	0.0582 (0.0476)	0.0302 (0.0261)	0.0497 (0.0458)	0.0160 (0.0592)
10 years after displacement	0.1051** (0.0469)	−0.0069 (0.0235)	−0.0908** (0.0380)	−0.1124** (0.0493)
Adjusted R^2	0.0416	0.0975	0.1074	0.1357
N	4930	16 481	6 995	5200

Notes: Heteroskedasticity-consistent robust SEs are in parentheses. In addition to the listed independent variables, each equation includes a vector of year dummy variables and allows for individual fixed effects. Hourly wage rates and annual earnings are measured in 1995 dollars.
***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.

Table 6. Long-run wage and earnings effects of job displacement on annual earnings, by level of educational attainment

	Dependent variables: ln real annual earnings			
Variables	Less than a high school diploma (a)	High school diploma or equivalent (b)	Some college (c)	At least a 4-year college degree (d)
Age of worker	0.4587*** (0.0362)	0.0310** (0.0136)	0.4458*** (0.0417)	0.4872*** (0.0082)
Age of worker squared	−0.0058*** (0.0008)	−0.0003 (0.0001)	−0.0059*** (0.0006)	−0.0064*** (0.0001)
Union affiliation	0.0932** (0.0407)	0.0163 (0.0162)	0.0323 (0.0286)	−0.0397 (0.0383)
Tenure (in weeks)	0.0003*** (0.00004)	0.0002*** (0.00001)	0.0001*** (0.00002)	0.0001*** (0.00002)
Tenure squared	−0.00009*** (0.00002)	−0.00005*** (0.00001)	−0.00006** (0.00004)	−0.00008* (0.00006)
5 years before displacement	0.0029 (0.0742)	−0.0443 (0.0330)	−0.1092* (0.0585)	−0.1076 (0.0974)
4 years before displacement	−0.0268 (0.0497)	−0.0455 (0.0290)	−0.0284 (0.0489)	0.0205 (0.0797)
3 years before displacement	−0.0483 (0.0863)	−0.1465*** (0.0362)	−0.2446*** (0.0738)	−0.1769* (0.1027)
2 years before displacement	−0.0492 (0.0423)	−0.0620*** (0.0227)	−0.0013 (0.0628)	−0.0715 (0.0613)
1 year before displacement	−0.0458 (0.0504)	−0.0751** (0.0308)	−0.1881*** (0.0554)	−0.0658 (0.0814)
Year of displacement	−0.0196 (0.0302)	−0.0826*** (0.0166)	−0.0591** (0.0287)	−0.1405*** (0.0514)
1 year after displacement	−0.0396 (0.0585)	−0.1468*** (0.0281)	−0.2363*** (0.0482)	−0.2363 (0.0642)
2 years after displacement	−0.1133*** (0.0396)	−0.1585*** (0.0218)	−0.1244*** (0.0385)	−0.1601*** (0.0513)
3 years after displacement	−0.0712 (0.0684)	−0.2595*** (0.0337)	−0.2345*** (0.0508)	−0.1257* (0.0668)
4 years after displacement	0.0325 (0.0507)	−0.0790*** (0.0266)	−0.0681 (0.0464)	−0.1319** (0.0555)
5 years after displacement	0.0435 (0.0694)	−0.0857*** (0.0309)	−0.1392*** (0.0540)	−0.0894 (0.0859)
6 years after displacement	0.1984*** (0.0615)	−0.0267 (0.0295)	−0.1908*** (0.0295)	−0.0613 (0.0748)
7 years after displacement	0.1235** (0.0594)	−0.0058 (0.0310)	−0.0570 (0.0555)	−0.1193* (0.0720)
8 years after displacement	0.1363* (0.0724)	−0.0352 (0.0370)	−0.0245 (0.0651)	−0.1624* (0.0901)
9 years after displacement	0.0879 (0.0752)	0.0024 (0.0309)	0.0661 (0.0602)	0.0223 (0.0827)
10 years after displacement	0.1387** (0.0668)	0.0067 (0.0289)	−0.1159** (0.0460)	−0.1281** (0.0574)
Adjusted R^2	0.0824	0.1012	0.0541	0.1068
N	3755	13 432	5994	4753

Notes: Heteroskedasticity-consistent robust SEs are in parentheses. In addition to the listed independent variables, each equation includes a vector of year dummy variables and allows for individual fixed effects. Hourly wage rates and annual earnings are measured in 1995 dollars.
***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.

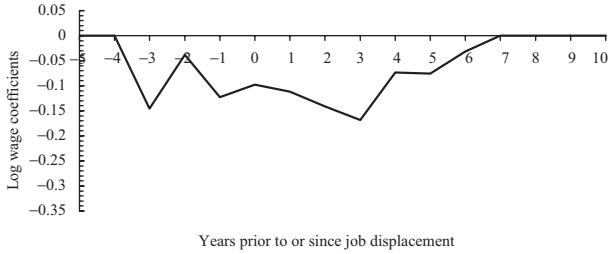

Fig. 1. Real wage and earnings losses relative to expected levels (all workers – wage losses)

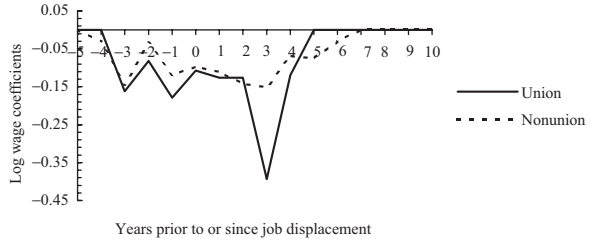

Fig. 2. Real wage and earnings losses relative to expected levels (by union affiliation – wage losses)

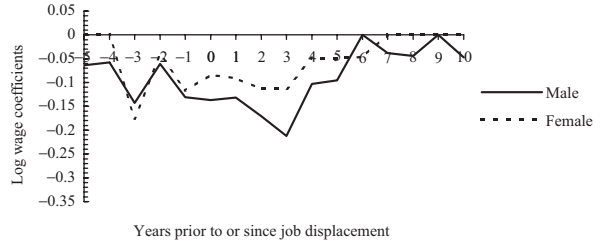

Fig. 3. Real wage and earnings losses relative to expected levels (by gender – wage losses)

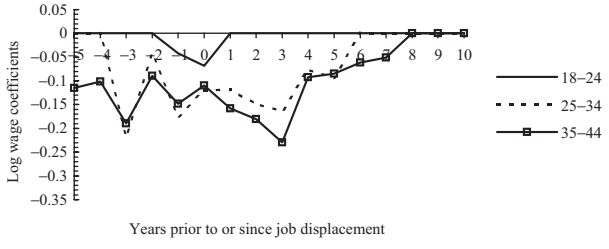

Fig. 4. Real wage and earnings losses relative to expected levels (by age classification – wage losses)

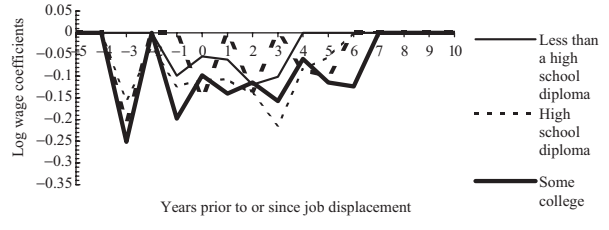

Fig. 5. Real wage and earnings losses relative to expected levels (by educational attainment – wage losses)

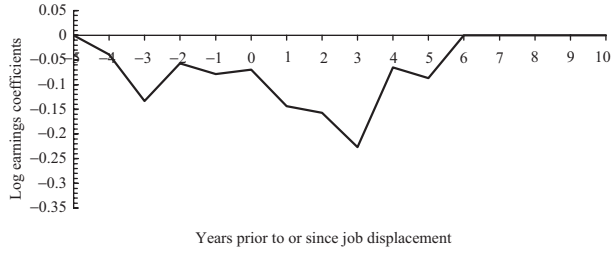

Fig. 6. Real wage and earnings losses relative to expected levels (all workers – earnings losses)

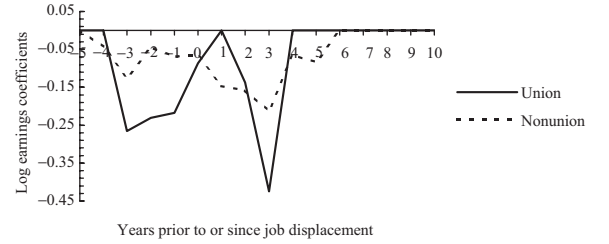

Fig. 7. Real wage and earnings losses relative to expected levels (by union affiliation – earnings losses)

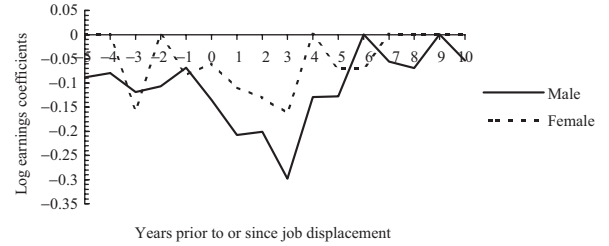

Fig. 8. Real wage and earnings losses relative to expected levels (by gender – earnings losses)

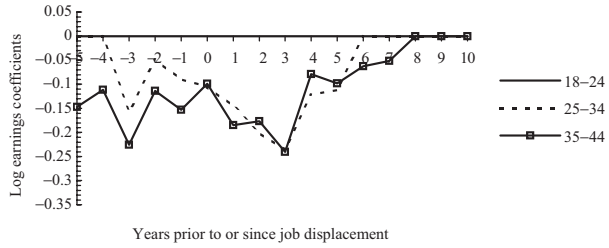

Fig. 9. Real wage and earnings losses relative to expected levels (by age classification – earnings losses)

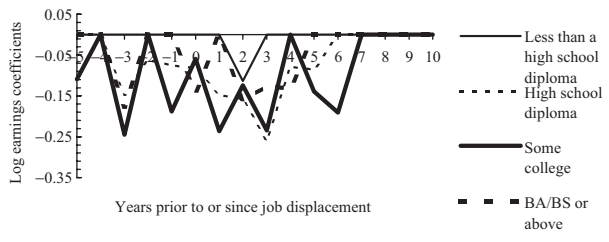

Fig. 10. Real wage and earnings losses relative to expected levels (by educational attainment – earnings losses)

For the full sample, the coefficients on the displacement-related variables are negative and significant beginning 3 (4) years prior to displacement and continuing through the 6th (5th) year following displacement when real hourly wages (annual earnings) is employed as the dependent variable [see columns (a) and (b) of Table 2]. This finding is consistent with prior research and the remaining coefficients are largely in line with expectations. Capturing the concavities of the age- and tenure-earnings profiles, the coefficients on the age and age-squared variables are positive and negative, respectively, as are the coefficients on the tenure and tenure-squared variables. The coefficient on the dummy variable representing union status is positive, reflecting an earnings premium.

Real annual earnings losses are derived as the sum of the percent differentials in annual earnings multiplied by mean real annual earnings of nondisplaced workers. Total pre-displacement earnings losses equal $9912 for the typical worker. Estimated post-displacement earnings losses equal $24 153. Thus, total displacement-related losses are equal to $34 065 for the typical worker. This is equivalent to a 10.8% loss when compared to earnings of the typical nondisplaced worker. The losses estimated here, for the full sample, are similar to the $50 000 estimate produced by Jacobson *et al.* (1993); however, the value presented here is arguably more precise as the NLSY79 data permit consideration of additional control variables.

Nonunion workers, as compared to their unionized counterparts, experience relatively greater durations of wage and earnings losses. For both groups, losses begin 4 years prior to displacement; however, 5 years after displacement, wages of nonunion workers remain 7.5% below their expected level, while union workers face no loss. Similarly, 4 years after displacement, earnings losses of displaced union have dissipated; however, for nonunion workers, an earnings loss of 8.3% is reported. The differences in time paths of losses notwithstanding, due to higher average earnings of union workers, total displacement-related earnings losses are greater for union workers ($47 618) as compared to nonunion workers ($32 439).

The typical displaced male worker, compared to his female counterpart, realizes wage losses earlier and experiences losses over a greater period of time. Following displacement, the time paths of wage losses are comparable for male and female workers; however, estimated wage losses for male workers are consistently of larger magnitude than those of female workers. The typical displaced male worker faces an estimated long-run earnings loss of $57 282, while the typical female worker losses $26 593. The earlier onset of pre-displacement losses, the lengthier duration of losses, the higher average incomes males receive and the proportionally greater wage losses all contribute to the observed greater earnings losses for male workers.

Considerable variation in losses is reported across age groups. For workers aged 20–24 years, wage losses are found only in the year immediately prior to and in the year of displacement. This is in stark contrast to the losses of displaced workers aged 35–44 years. This eldest group realizes wage losses as early as 5 years prior to displacement and sees such losses persist 7 years after displacement. As displacement often results in a loss of firm- and/or industry-specific human capital, it stands to reason that the positive correlation between ages and levels of human capital leads to higher earnings for more mature workers. Thus, displacement that leads to a loss of such capital generates greater expected losses for more mature workers relative to younger workers. We see that, on average, more mature workers have higher incomes, thus the observed proportional wage losses translate into greater earnings losses. Workers at least 35 years of age are estimated to lose $64 637 in earnings due to displacement. Workers aged 25–34 years face an estimated loss of $39 542, while the youngest cohort – due to the minimal wage losses incurred – realizes no significant earnings loss.

To examine losses across education levels, each worker has been classified into one of four educational attainment groups: college graduates, those who have completed some college coursework, high school diploma holders and those with less than a high school education. While significant wage losses are reported for each group, the magnitude and timing of losses vary. The least-educated cohort – those who did not complete high school – realizes wage losses beginning the year immediately prior to displacement and continuing 3 years after displacement. Workers with a 4-year college degree do not appear to experience pre-displacement wage losses, but do face losses through the 6th year following displacement. To the contrary, the middle two groups experience wage losses as early as 3 years prior to displacement. Additionally, workers who have a high school diploma see persistent losses 5 years after displacement, while workers who have completed some college coursework face losses even 6 years after displacement. The protracted duration of wage losses, coupled with greater proportional decreases in wages relative to comparable nondisplaced workers leads to higher estimated earnings losses for these two groups.

The typical displaced worker with only a high school diploma incurs estimated long-run losses of

$32 972, while the typical displaced worker who has completed some college faces an estimated loss of $50 326. The abbreviated time span of wage losses for the least and most educated groups leads to reduced estimates of earnings losses ($3294 for those without a high school diploma and $21 353 for college graduates). In general, earnings are highly correlated with education. However, if college-educated workers are more likely to hold general skills that may transfer across firms and industries, it is not surprising to see this cohort's lower estimated earnings losses.

V. Conclusion

Estimates of displacement-related wage and earnings losses have been derived and variation in long-run earnings losses across worker types has been identified. We confirm the findings of prior literature reporting that the typical worker faces large and persistent displacement-related losses. Wage losses begin as early as 3 years prior to displacement, and 5 years following displacement the real hourly wage rate of the typical displaced worker remains approximately 2.8% below the expected hourly wage rate. A period of 4 years prior to displacement, annual earnings losses are estimated at 3.9%. These losses persist through the 5th year following displacement during which earnings losses of 8.7% are estimated. In total, the typical displaced worker realizes long-run losses of $34 065, which is equivalent to a 10.8% loss compared to earnings of similar nondisplaced workers.

Extending the literature, we report considerable variation in the timing, magnitude and duration of wage and earning losses. Generally, losses are found to increase with education; however, college graduates – due to a relatively brief duration of post-displacement losses – face smaller losses compared to high school graduates and those with some college coursework completed. The duration of wage losses for nonunion workers is longer than that experienced by union workers. However, due to higher earnings and a greater magnitude of losses, union workers realize larger earnings losses than their nonunion counterparts. Displaced male workers experience greater wage and earning losses than do female workers and wage and earnings losses appear to increase with age. Given the policy importance associated with job displacement, the results reported provide useful insight into the corresponding long-run effects.

References

Addison, J. T. and Portugal, P. (1989) Job displacement, relative wage changes, and duration of unemployment, *Journal of Labor Economics*, **7**, 281–302.

Blanchflower, D. (1991) Fear, unemployment and pay flexibility, *The Economic Journal*, **51**, 483–96.

Carrington, W. J. and Asad, Z. (1994) Interindustry variation in the costs of job displacement, *Journal of Labor Economics*, **12**, 243–75.

de la Rica, S. (1995) Evidence of preseparation earnings losses in the displaced workers survey, *The Journal of Human Resources*, **30**, 610–21.

Farber, H. S. (1993) The incidence and costs of job loss: 1982–91, *Brookings Papers on Economic Activity: Microeconomics*, **1993**, 73–119.

Farber, H. S. (2005) What do we know about job loss in the United States? Evidence from the displaced workers survey, 1984–2004, *Economic Perspectives*, **2**, 13–28.

Hall, R. and Pencaval, J. (1993) The incidence and costs of job loss: 1982–91. Comments and discussion, *Brookings Papers on Economic Activity: Microeconomics*, **1993**, 120–32.

Jacobson, L., Robert, L. and Daniel, S. (1993) *The Costs of Worker Dislocation*, W.E. Upjohn Institute for Employment Research, Kalamazoo, MI.

Kletzer, L. G. (2001) *Job Loss from Imports: Measuring the Costs*, Institute for International Economics, Washington, DC.

Kletzer, L. G. and Fairlie, R. (2003) The long-term costs of job displacement for young adult workers, *Industrial and Labor Relations Review*, **56**, 682–98.

Neal, D. (1995) Industry-specific human capital: evidence from displaced workers, *Journal of Labor Economics*, **13**, 653–77.

Podgursky, M. and Swaim, P. (1987) Job displacement and earnings loss: evidence from the displaced workers survey, *Industrial and Labor Relations Review*, **41**, 17–29.

Ruhm, C. J. (1987) The economic consequences of labor mobility, *Industrial and Labor Relations Review*, **41**, 30–42.

Ruhm, C. J. (1991) Are workers permanently scarred by job displacements?, *The American Economic Review*, **81**, 319–24.

Stevens, A. H. (1997) Persistent effects of job displacement: the importance of multiple job losses, *Journal of Labor Economics*, **15**, 165–88.

United States Bureau of Labor Statistics (BLS) (2002) National Longitudinal Survey of Youth 1979 Cohort, 1979–2000 (Rounds 1–19) (Computer File), Produced and distributed by the Center for Human Resource Research, The Ohio State University, Columbus, OH.